General Linear Hypothesis 2-1

$C\Delta = g \ , \quad H_0: \ C\Delta - g = 0$

$$\frac{(C\Delta - g)^T \left[C N^{-1} C^T\right]^{-1} (C\Delta - g)}{s \cdot \hat{\sigma}_0^2} \sim F_{s,r}$$

Note: I had transpose symbols backwards in middle term. Corrected here. Also changed $\tilde{X} \to \Delta$ for NL problems

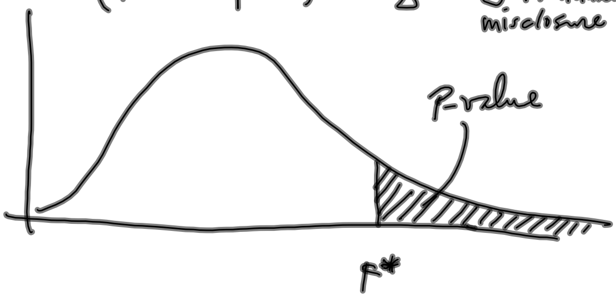
$\underset{s,m}{C}$: constraint matrix

r: redundancy (unconstr. prob.)

$\hat{X}$: est. parameters without using constraints, eval. g @ $\hat{X}$

$\hat{\sigma}_0^2 = v^T W v / r$

$\Delta = 0$ in numerator, g represents misclosure



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$\vec{y} = y(\vec{x}) \qquad \vec{y}$ indep. of $\vec{t}$ 2-2

$\vec{z} = z(\vec{t}) \qquad \vec{z}$ indep of $\vec{x}$

$\vec{x}$ & $\vec{t}$ are statistically related

$J_{yx} = \frac{\partial y}{\partial x} \ , \quad J_{zt} = \frac{\partial z}{\partial t}$ jacobians matrices

$\vec{r} = \begin{bmatrix} \vec{y} \\ \vec{z} \end{bmatrix} , \quad \vec{s} = \begin{bmatrix} \vec{x} \\ \vec{t} \end{bmatrix}$

$$J_{rs} = \begin{bmatrix} J_{yx} & 0 \\ 0 & J_{zt} \end{bmatrix}$$

$$Q_{rr} = J_{rs} Q_{ss} J_{rs}^T$$

$$\begin{bmatrix} Q_{yy} & Q_{yz} \\ Q_{zy} & Q_{zz} \end{bmatrix} = \begin{bmatrix} J_{yx} & 0 \\ 0 & J_{zt} \end{bmatrix} \begin{bmatrix} Q_{xx} & Q_{xt} \\ Q_{tx} & Q_{tt} \end{bmatrix} \begin{bmatrix} J_{yx}^T & 0 \\ 0 & J_{zt}^T \end{bmatrix}$$

$$= \begin{bmatrix} J_{yx} Q_{xx} J_{yx}^T & J_{yx} Q_{xt} J_{zt}^T \\ J_{zt} Q_{tx} J_{yz}^T & J_{zt} Q_{tt} J_{zt}^T \end{bmatrix}$$

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$$Q_{yy} = J_{yx} Q_{xx} J_{yx}^T$$ 2-3

$$Q_{yz} = J_{yx} Q_{xt} J_{zt}^T$$

$$Q_{zy} = J_{zt} Q_{tx} J_{yx}^T = Q_{yz}^T$$

$$Q_{zz} = J_{zt} Q_{tt} J_{zt}^T$$

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corollary : $\begin{bmatrix} u \\ v \end{bmatrix} = \begin{bmatrix} u \\ v(u) \end{bmatrix}$

$J_{uu} = I$, J_{vu} , Q_{uu}

$$Q_{uv} = \underset{\substack{\shortparallel \\ (I)}}{J_{uu}} Q_{uu} J_{vu}^T$$

$$= Q_{uu} J_{vu}^T$$

this is needed for HW1 1-6

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$$\begin{bmatrix} x \\ y \\ -f \end{bmatrix} = \lambda M \begin{bmatrix} X - X_c \\ Y - Y_c \\ Z - Z_c \end{bmatrix} = \lambda \begin{bmatrix} u \\ v \\ w \end{bmatrix}$$ 2-4

assume x, y are reduced to P.P. & corrected for L.D.

$\frac{x}{-f} = \frac{u}{w}$ $\quad x = -f \cdot u/w$

$\frac{y}{-f} = \frac{v}{w}$ $\quad y = -f \cdot v/w$

$\begin{pmatrix} x \\ y \end{pmatrix} = \text{fcoll}(f, \omega, \varphi, \kappa, X_c, Y_c, Z_c, X, Y, Z)$

$\begin{pmatrix} dx \\ dy \end{pmatrix} = \text{fcollLO}(x, y, f, \omega, \varphi, \kappa, X_c, Y_c, Z_c, X, Y, Z)$

$dx = x_o - x_c$

$dy = y_o - y_c$

compile using fcoll

arguments

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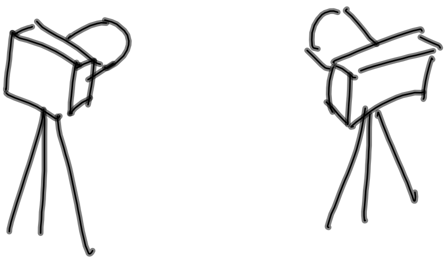
$$= \text{fcoll\_D\_part}(x, y, f, \underbrace{\omega, \varphi, \kappa}_{\text{radians}}, X_L, Y_L, Z_L, X, Y, Z)$$

$$\begin{bmatrix} \frac{\partial F_x}{\partial f} & \frac{\partial F_x}{\partial \omega} & \frac{\partial F_x}{\partial \varphi} & \frac{\partial F_x}{\partial \kappa} & \frac{\partial F_x}{\partial X_L} & \frac{\partial F_x}{\partial Y_L} & \frac{\partial F_x}{\partial Z_L} & \frac{\partial F_x}{\partial X} & \frac{\partial F_x}{\partial Y} & \frac{\partial F_x}{\partial Z} \\ \frac{\partial F_y}{\partial f} & \frac{\partial F_y}{\partial \omega} & \frac{\partial F_y}{\partial \varphi} & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \end{bmatrix}$$



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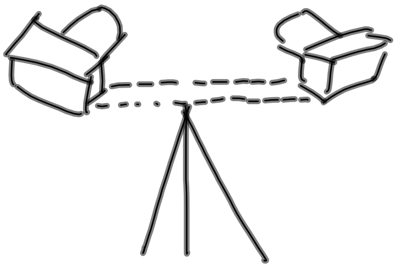

describe this fixed geometry with constraint eqns

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